A Dissertation on

"STUDY OF INCISIONAL HERNIA- EVALUATION OF RISK FACTORS AND OUTCOME OF VARIOUS SURGICAL TECHNIQUES USED IN THE INCISIONAL HERNIA REPAIR"

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CERTIFICATE

This is to certify that the dissertation titled **"STUDY OF INCISIONAL HERNIA- EVALUATION OF RISK FACTORS AND OUTCOME OF VARIOUS SURGICAL TECHNIQUES USED IN THE INCISIONAL HERNIA REPAIR"** is the bonafide work done by **Dr.R.KARTHIKEYAN**, during his M.S. General Surgery course 2015-18, under my guidance and supervision in partial fulfillment of the rules and regulations laid down by The Tamil Nadu Dr. M.G.R. Medical University, Chennai for M.S. (Branch-I) General Surgery Examination, MAY 2018.

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DECLARATION

I, **Dr.R.KARTHIKEYAN,** certainly declare that this dissertation titled **"STUDY OF INCISIONAL HERNIA- EVALUATION OF RISK FACTORS AND OUTCOME OF VARIOUS SURGICAL TECHNIQUES USED IN THE INCISIONAL HERNIA REPAIR"** represents a genuine work of mine. The contributions of any supervisors to the research are consistent with normal supervisory practice and are acknowledged. I also affirm that this bonafide work or part of this work was not submitted by me or any others for any award, degree or diploma to any other university board, either in India or abroad. This is submitted to the Tamil Nadu Dr. M.G.R. Medical University, Chennai in partial fulfillment of the rules and regulations for the award of Master of Surgery degree Branch 1 (General Surgery).

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CERTIFICATE OF APPROVAL

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Dear Dr.R.Karthikeyan,

The Institutional Ethics Committee has considered your request and approved your study titled **"STUDY OF INCISIONAL HERNIA – EVALUATION OF RISK FACTORS AND OUTCOME OF VARIOUS SURGICAL TECHNIQUES USED IN THE INCISIONAL HERNIA REPAIR " - NO.24012017 (II).**

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We approve the proposal to be conducted in its presented form.

The Institutional Ethics Committee expects to be informed about the progress of the study and SAE occurring in the course of the study, any changes in the protocol and patients information/informed consent and asks to be provided a copy of the final report.

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CONTENTS

INTRODUCTION

INTRODUCTION

Incisional hernia is defined by the European hernia society as ”**any abdominal wall gap with or without a bulge in the area of postoperative scar perceptible or palpable by clinical examination or imaging”.**

Development of Incisional Hernia can follow any type of surgical incision, whatever its site or size, even the incision of the laparoscope trocar can cause it. Incisional Hernia was reported as a complication of abdominal surgery since the early days of surgery, Greedy (1836) and Maydl(1886) reported repair of Incisional Hernia, Judd (1912) and Gibbon(1920) described the anatomical repair of Incisional Hernia ,Kirschner (1910) introduced the auto graft (fascia lat, skin) and hetero graft (skin) for repairing Incisional Hernia.

The incidence of Incisional Hernia is still high, in spite of the great improvement in the techniques and suture materials used for closing the abdominal wall incisions. Many procedures and techniques were described for preventing and repairing Incisional Hernia; using different suture materials, suture repair, prosthetic repair, combination of different techniques or laparoscope. In spite of the many efforts for reducing the incidence of Incisional hernia, still there is a lack of consensus regarding the best approach for preventing and repairing Incisional Hernia, because most of them are followed by complications. Incisional Hernia represents a major surgical issue for surgeons of all specialties.

The aim of the present article is to review the risk factors and management of the Incisional hernia and its complication.

This study was conducted at the Institute of General Surgery, Madras Medical College and Rajiv Gandhi Government General Hospital.

AIMS AND OBJECTIVES

AIM

TO EVALUATE THE RISK FACTORS OF INCISIONAL HERNIA AND OUTCOME OF VARIOUS SURGICAL TECHNIQUES USED IN THE INCISIONAL HERNIA REPAIR"

OBJECTIVES

- To evaluate the risk factors associated with Incisional Hernia.
- To develop a strategy for an effective management of Incisional Hernia by studying the outcomes of various techniques in the incisional hernia repair.
- To study the post-operative morbidity of various surgical techniques.

REVIEW OF LITERATURE

REVIEW OF LITERATURE

EPIDEMIOLOGY

Incidence

Incisional hernias have been reported in 10–50 per cent of laparotomy incisions and 1–5 per cent of laparoscopic port-site incisions. Factors predisposing to their development are patient factors (obesity, general poor healing due to malnutrition, immune suppression or steroid therapy, chronic cough, cancer), wound factors (poor quality tissues, wound infection) and surgical factors (inappropriate suture material, incorrect suture placement). An incisional hernia usually starts as disruption of the musculo fascial layers of a wound in the early postoperative period. Often the event passes unnoticed if the overlying skin wound has healed securely. Many incisional hernias may be preventable with the use of good surgical technique. The classic sign of wound disruption is a sero sanguinous discharge.

- A postoperative ventral abdominal wall hernia, more commonly termed incisional hernia, is the result of a failure of fascial tissues to heal and close following laparotomy. Such hernias can occur after any type of abdominal wall incision, although the highest incidence is seen with midline and transverse incisions.
- Postoperative ventral hernias following paramedian, subcostal, McBurney, Pfannenstiel, and flank incisions have also been described in the literature. Laparoscopic port sites may also develop hernia defects in the abdominal wall fascia.

- Incisional hernias enlarge over time, leading to pain, bowel obstruction, incarceration, and strangulation. Obesity, advanced age, malnutrition, ascites, pregnancy, and conditions that increase intra-abdominal pressure are factors that predispose to the development of an incisional hernia.
- Obesity can cause an incisional hernia to occur, owing to increased tension on the abdominal wall provided by the excessive bulk of a thick pannus and large omental mass.
- Chronic pulmonary disease and diabetes mellitus have also been recognized as risk factors for the development of incisional hernia.
- Medications such as corticosteroids and chemotherapeutic agents and surgical site infection can contribute to poor wound healing and increase the risk for developing an incisional hernia.
- Large hernias can result in loss of abdominal domain, which occurs when the abdominal contents no longer reside in the abdominal cavity
- These large abdominal wall defects also can result from the inability to close the abdomen primarily because of bowel edema, abdominal packing, peritonitis, and repeat laparotomy.
- With loss of domain, the natural rigidity of the abdominal wall becomes compromised, and the abdominal musculature is often retracted. Respiratory dysfunction can occur because these large ventral defects cause paradoxical respiratory abdominal motion.
- Return of displaced viscera to the abdominal cavity during repair may lead to increased abdominal pressure, abdominal compartment syndrome, and acute respiratory failure. Polypropylene mesh has

been used extensively and allows for in growth of native fibroblasts and incorporation into the surrounding fascia.

- It is semi rigid, somewhat flexible, and porous. Placing polypropylene mesh in an intra peritoneal position directly apposed to the bowel is avoided because of unacceptable rates of entero cutaneous fistula formation.

ANTERIOR ABDOMINAL WALL

Anatomy:

The anterior abdominal wall is limited above by xiphi sternum, right and left coastal margins, below bye anterior part of the iliac crust, fold of the groin, pubic tubercle, pubic crest and symphysis pubis, and on each side separated from the posterior abdominal wall by downward prolongation of mid axillary line.

The anterior wall is firm but and consists of 8 layers from before backwards- skin, superficial fascia, external oblique muscle and its aponeurosis, internal oblique muscle and its aponeurosis, transversus abdominis muscle and it's aponeurosis, fascia transversalis, extra peritoneal tissue and parietal peritoneum.

1. **SKIN:** It is thinner and more sensitive. It presents two parts an Outer epidermis which is non vascular and an inner dermis or corium which is highly vascular and presents rich blood supply. The skin presents a medium longitudinal groove overlying the linea alba, and a

curved grove on each side with convexity directed laterally which corresponds with lateral border of rectus abdominis muscle.

2. **SUPERFICIAL FASCIA:** It consist of a single layer above the line joining the two anterior superior iliac spines. Below this line it splits into superficial fatty layer (Campers fascia) and deep membranous layer (Scarpas fascia). Fascia of camper is continuous with subcutaneous fat of adjoining areas; over there scrotum the fatty tissue is replaced by dartos muscle. Fascia of scarpa is made of Elastic fibres tissue and is attached in the midline to the Linea Alba and is continued in front of symphysis pubis as the fundiform ligament of penis. The space between that two layers is occupied by superficial epigastric, external pudental and circumflex iliac vessels and superficial inguinal lymph nodes.
3. **EXTERNAL OBLIQUE MUSCLE:** Also known as oblique externus abdominis. Origin is by eight fleshy slips from the outer surfaces and lower borders of the lower eight ribs. The upper four slips interdigitate with serratus anterior and lower four slips with lattismus dorsi. **Insertion-** The most posterior fibres pass vertically downwards and are inserted to the anterior half of outer lip of iliac crest. Its posterior margin is free and forms the anterior boundary of lumbar triangle. The remaining fibres pass downwards and forwards and medially and end in a broad aponeurosis. The aponeurosis passes in front of the rectus abdominis forming the anterior wall of the rectus sheath and is inserted into linea alba. The upper border of aponeurosis is horizontal and is overlapped by pectoralis major muscle. The lower border is thickened and folded backwards to form

the inguinal ligament. **Nerve supply –** Ventral rami of lower six thoracic nerves.

4. **INTERNAL OBLIQUE MUSCLE:** also known as obliqus internus abdominis. Origin is from lateral 2/3rd of upper surface of the inguinal ligament. According to McVay and Anson(1940) the internal oblique muscle does not actually arise from the inguinal ligament, but from the fascia iliaca close to the ligament. Also arises from intermediate lip of the ventral segment of the iliac crest and from the fusion of anterior and middle layers of thoraco-lumbar fasciac at the lateral border of quadrates lumborum. **Insertion** - Inguinal fibers pass upwards and medially forming anterior wall of the inguinal canal, then arch backwards forming the roof and finally turn downwards and medially and become aponeurotic. The aponeurosis of the internal oblique forms the conjoint tendon after blending with similar aponeurosis of the transverses muscle and is inserted into the pubic crest. The most posterior fibers pass vertically upwards and are inserted to the lower border of lower 3 or 4 ribs and their costal cartilages. The remaining fibers pass at right angles to the fibers of external oblique and end in aponeurosis. At the lateral border of the rectus abdominis the aponeurosis splits into anterior and posterior lamellae to enclose the rectus muscle and is inserted into the linea alba. The splitting of the aponeurosis extends from the costal margin to a point mid-way between umbilicus and symphysis pubis. **Nerve supply** - Ventral rami of lower six thoracic nerves and first lumbar nerve.
5. **TRANSVERSUS ABDOMINIS MUSCLE:** It is named so because most of its fibers are horizontal. **Origin**-From the lateral 1/3rd of

upper surface of inguinal ligament, anterior 2/3rdof inner lip of iliac crest, thoraco lumbar fascia at the lateral border of quadrates lumborum, inner surface of lower six ribs and their costal cartilages. **Insertion** - Inguinal fibers arch backwards forming the roof of inguinal canal and turn medically to become aponeurotic and form the conjoint tendon and are inserted into pubic crest. The remaining fibers end in an aponeurosis which is narrow towards the xiphoid process and wide at the umbilical region. It is inserted into the linea alba. The upper 3/4th reaches linea alba forming the posterior wall ofthe rectus sheath and the lower 1/4th reaches forming the anterior wall of rectus sheath. **Nerve supply** - Ventral rami of lower six thoracic nerves and first lumbar nerve.

6. **CONJOINT TENDON:** Also known as falx ingunalis. It is formed by fusion of inguinal fibers of internal oblique and transverses abdominis muscles. It forms the medial half of the posterior wall of inguinal canal.
7. **FASCIA TRANSVERSALIS:** It is an areolar membrane which lines the inner surface of the transverses muscle and forms an endo-abdominal fascia. Traced in front, it is continuous with similar fascia of the opposite side. Behind, it is continuous with the renal fascia along the lateral border of kidney. Above, it is continuous with ill-defined sub diaphragmatic fascia. Below, it is well defined and is attached to the inner lip of iliac crest, posterior margin of inguinal ligament and to pectin pubis and pubic crest. The thickened lower part of fascia transversalis forms the ilio-pubic tract (Thomsons ligament) which extends from anterior superior iliac spine to the pubis.

8. **EXTRA-PERITONEAL TISSUE:** It is composed of fibro-areolar and fatty tissue and is traversed by following structures medial to deep inguinal ring-inferior epigastric artery before it pierces the fascia transversalis. Obliterated umbilical artery, passing towards the umbilicus, median umbilical extending from the apex of the urinary bladder to the umbilicus.

ACTIONS OF MUSCLES OF ANTERIOR ABDOMINAL WALL

a. **Retention** - Muscles retain the viscera in position. This is maintained by the tone of the muscles.
b. **Protection** - Protect the viscera from external injury. This done mainly by two recti.
c. **Compression** - Increase the intra-abdominal pressure and compress the viscera the act of vomiting, micturition or defecation. During compression, the diaphragm is pushed upwards helping expiration.
d. **Actions on vertebral column:**
    1. When muscles of both sides act, lumbar vertebrae are flexed.
    2. In unilateral action of the muscles, the trunk is bent laterally producing lateral flexion.
    3. When the external oblique of one side contracts simultaneously with the internal oblique of other side, rotation of trunk takes place.

RECTUS SHEATH: It is an aponeurotic envelope for rectus abdominis muscle on each side of lineaalba. The sheath acts as a retinaculum and prevents the muscle from bow-stringing. The principle of formation of the

sheath is the splitting of aponeurosis of internal oblique at the lateral border of rectus muscle. The splitting extends from the costal margin to the mid-way between umbilicus and symphysis pubis. Below that the internal oblique doesn't split and passes together with the tranversus aponeurosis in front of the rectus muscle. Below the arcuate line, the wall is deficient and the rectus muscle is covered by thickened part of fascia transversalis. Contents are rectus abdominis and pyramidalis muscle, inferior and superior epigastric vessels, lower five intercostal and sub costal nerves.

RECTUS ABDOMINIS: It is a long strap muscle, wider above than below. **Origin** - Medial head arises from anterior surface of symphysis pubis. Lateral head arises from lateral part of pubic crest and pubic tubercles. **Insertion**- By four fleshy slips in a horizontal line. The most medial slip is attached to the anterior surface of xiphoid process. The remaining three slips are attached from lateral to medial side to the 5^{th}, 6^{th} and 7^{th}costal cartilages. **Nerve supply**-Lower five intercostal and subcostal nerves. **Actions** - Provide protection to the abdominal viscera from external injury. Compress the abdominal cavity and maintain intra-abdominal pressure. Produce flexion of vertebral column.

PYRAMIDALIS: It is triangular or pyramidal in shape. Sometimes the muscle is absent on one or both sides. **Origin**-From the symphysis pubis and pubic crest. **Insertion** - Its apex it is inserted into the linea alba, midway between the umbilicus and symphysis pubis. **Nerve supply**-Subcostal nerve. **Action**- It is a tensor of the linea alba, but the purpose of tension is not known.

LINEA ALBA: The lineaalba is a tendinous raphe formed by interlacing fibers of the three aponeurosis forming the rectus sheath. It extends from the xiphoid process to the pubic symphysis. Above the umbilicus it is about 1 cm wide, but below the umbilicus it is narrow and difficult to define.

CONJOINT TENDON: It is formed from lower fibers of internal oblique and lower part of aponeurosis of transverse abdominis. It is attached to pubic crest and pectineal line. It descends behind the superficial inguinal ring and acts to strengthen the medial portion of the posterior wall of the inguinal canal.

ANATOMY OF UMBILICUS: The umbilicus is a cicatrix which represents the site of entry of the umbilical cord in the fetus. The floor of the umbilicus is formed by the fibrous tissue. The scar is directly adherent to the superficial fascia, because the fatty tissue ceases at the margin of the umbilical ring. Deep to this are situated the inter lacing transverse fibers known as "umbilical fascia". The fetal umbilical vessels and urachus create a weak spot through which protrusion of viscus can occur. The most frequent point of exit of a hernia is a site of the umbilical veins represented in the adults by the attachment of a ligamentum teres. A horizontal line drawn across the umbilicus acts as a watershed line, because subcutaneous lymphatic's from the upper area of abdominal wall drain bilaterally into axillary lymph nodes and those from lower area drain bilaterally into superficial inguinal lymph nodes.

SEGMENTAL INNERVATION: Band of skin at the level of umbilicus is supplied by 10^{th} thoracic nerve above the umbilical zone and extending up to the xiphi sternum, the skin is supplied segmentally by preceding 3 nerves

(7^{th}, 8^{th}& 9^{th}), Below the umbilical zone up to the symphysis,skin is supplied by succeeding 3 nerves (11^{th} thoracic, subcostal & 1^{st}lumbar). The anterior abdominal wall is provided with seven consecutive dermatomes, which overlap one another.

REGIONS OF ABDOMEN: Abdomen is divided into 9 regions by 2 horizontal and 2 vertical imaginary planes. Upper horizontal plane is represented by trans pyloric plane of Addison. It passes in front through the 9th costal cartilages and behind through the lower border of L_1 vertebrae. Lower horizontal plane is represented by trans tubercular plane drawn by joining the tubercles of both iliac crests, traced behind passes through the upper part of L_5 vertebrae. Two vertical planes are each represented by the mid clavicular lines on either sides. The nine regions between the horizontal and vertical planes present 3 zones- upper, intermediate and lower. Upper zone consists of epigastric region in the middle and right and left hypochondriac regions on either side. Intermediate zone comprises umbilical region in the middle and right and left lumbar regions on each side. Lower zone includes hypogastric region in the middle and right and left iliac regions on each side.

ABDOMINAL WALL- LAPAROSCOPIC ANATOMY:

The internal surface of the anterolateral abdominal wall is covered with parietal peritoneum. The infra umbilical part of the surface exhibits several peritoneal folds, some of which contain remnants of vessels that carried blood to and from the fetus (Moore and Persaud, 1998)**.** Five infra umbilical peritoneal folds- two on each side and one in median plane- pass toward the umbilicus. The median umbilical fold extends from the apex of

the urinary bladder to the umbilicus and covers the median umbilical ligament, the remnant of the urachus (reduced allantoic stalk),that joined the apex of the fetal bladder to the umbilicus. Two medial umbilical folds, lateral to the median umbilical fold, cover the medial umbilical ligaments, the remnants of the occluded fetal umbilical arteries. Two lateral umbilical folds, lateral to the medial umbilical folds, cover the inferior epigastric vessels, which bleed if cut.

The depressions lateral to the umbilical folds is peritoneal fossae, each of which is apotential site for a hernia. The location of a hernia in one of these fossae determines how the hernia is classified. The shallow fossae between the umbilical folds are:

a. Supravesical fossae between the median and the medial umbilical folds, formed as the peritoneum reflects from the anterior abdominal wall onto the bladder. These are potential site for rare external vesical hernias. The level of the supravesical fossae rises and falls with filling and emptying of the bladder.
b. Medial inguinal fossae between the medial and lateral umbilical folds also known as the inguinal triangles.
c. Lateral inguinal fossae, lateral to the lateral umbilical folds, include the deep inguinal rings and are potential sites for the most common type of hernia in the lower abdominal wall –Indirect Inguinal hernia.

The supraumbilical part of the internal surface of the anterior abdominal wall has a sagittal oriented peritoneal reflection - the falciform ligament- that extends between the upper abdominal wall and the liver and

encloses the round ligament of the liver (ligamentum teres) in its inferior free edge. The round ligament is a fibrous remnant of the umbilical vein, which extends from the umbilicus to the liver prenatally.

HISTORY OF HERNIA:

Henias are among the oldest surgical challenges which have confronted the surgical community. The Egoptians (1500 B.C), the Phoenicians (900 B.C), and the ancient Greeks(Hippocrates 400B.C) diagnosed hernia during their times. The word Hernia is derived from the Greek word hernias which means a bud or an offshoot, a budding or a bulge. Hernia also meanstear in Latin literature. The earliest recorded reference to hernias appears in the Egyptian papyrus of Ebers (circa 1552 B.C). Hernia was treated by several ways with the available simple measures like bandages, ointment, poultices and localized concoctions.

Ambrose pare who described in his book, The Works published in 1634. Astly Cooper(1804) was the first person to report the successful treatment of exompholos and he was the originator of one stage repair of small omphalocele. Astley Cooper discovered the Transversalis Fascia and pointed out that this layer was the main barrier to herniation. Lucas Championnere apparently was one of the first to use the overlapping fascia technique in 1891.

EPIGASTRIC HERNIA:

Epigastric hernias were first described in 1285. The term epigastric hernia was introduced by Leveille in 1812. The first successful operation on

this hernia was reported by Maunnior in1802. Detailed anatomic descriptions were given by Bernitzin 1848 and Cruveilhier in 1849. Ulrike Muschaweck in 2003 concludes using a Mesh plug in an epigastric hernia has advantages over the commonly used methods.

UMBILICAL HERNIA:

The first references to umbilical hernias is in the Egyptian papyrus of ebers (circa 1552 BC) but the first formal description of umbilical hernias comes from the writings of Hindu Physician Charaka A.D.I or earlier. The first recorded description of umbilical hermia repair comes from Albucasis Abul Qasimalzahrawi the great Moorish surgeon (A.D. 1013-1106), but credit for the modern surgical treatment of umbilical hernia goes to William.J.Mayo who repaired these defects by over lapping fascia downward from above.

PARAUMBILICAL HERNIA:

Celsus in the first century A.D used anclastic suture in the treatment of umbilical hernias. Willian J Mayo, on Aug 4th 1898 delivered his classical paper, remarks on radical cure of hernia. He instituted the new classical technique of overlapping fascia for repair of umbilical hernia. In 1979 Usher described a technique of repair using Marlex Mesh.

INCISIONAL HERNIA:

Witzel (1900), Goepel (1900), Barlett (1903) and McGavin (1909) advocated the use of Silver wire filigree. Koontz and Throckmorton (1948) used Tantalum Gauze. Fascia Lata grafts used in the form of strips of sheets have been reported. Shortly the advent of synthetic Plastic sheets and the

polyvinylalcohol sponge were used. The Modern era of prosthetic hernia repair began in 1958 when Usher reported his experiment with Polyamide mesh. Later braided polyester mesh, polypropylene mesh and expanded polytetrafluoroethylene (ePTFE) were introduced which revolutionized the surgery for post-operative Hernia.

HISTORY OF SURGICAL MESHES:

Artificial material was introduced in 1889 by Witzel who used a mesh of silver wire for abdominal wall henias. In 1959, Usher et al. reported the successful implantation of surgical meshes at first in 13 dogs and later in patients with abdominal wall hernias. Busse in 1901 even used meshes made of gold wire. In 1940, Ogilvie published the use of cloth meshes to treat contaminated gunshot wounds with defects of the abdominal wall. In 1949, Preston took meshes of metallic wire to treat hernia patients.

CLASSIFICATION OF VENTRAL HERNIA:

Chevrel and Rath proposed a classification for incisional hernias in 2000. This classification is attractive, because it is simple, and the data required to reach the classification are readily obtained. Three parameters were utilized. Firstly, the localization of the hernia of the abdominal wall: divided into median (MI-M4) and lateral (LI-L4) hernias. Secondly, the size of the hernia: it was postulated that the width of the hernia defect is the most important parameter(greater than hernia defect surface, length of the hernia or size of the hernia sac), which was divided into four groups (W1-W4). As a third parameter of this classification, subgroups were made for incisional hernias and recurrences: the number of previous hernia repairs

was recorded as (RO, R1,R2, and R3). Although apparently easy to use, this classification has not been commonly used in the literature.

In his book on hernia surgery, Hernienl, Schumpelick described a classification that divided incisional hernias into five classes. The size of the defect, the clinical aspect of the hernia in lying and standing position, the localization of the incision and the number of previous repairs were used for this classification.

Korenkov et al. reported on the results of an expert meeting on classification and surgical treatment of incisional hernia, but no detailed classification proposal resulted from this meeting.

Ammaturo and Bassi suggested an additional parameter to the Chevrel classification. The ratio between the anterior abdominal wall surface and the wall defect surface predicts a strong abdominal wall tension when closing the defect, with possible abdominal compartment syndrome development, and thus might influence the choice of surgical technique.

Recently, Dietz et al. proposed another alternative classification of incisional hernias in which variables like body type, hernia morphology and risk factors for recurrence were included and recommendations made for surgical repair based on the different types. It is based on a self-explanatory taxonomy and is intended to tailor the repair to the body type and risk factors of the individual patient.

The most recent and widely accepted classification is made by European Hernia Society which is based on 2 variables: Localization of the hernia and size of hernia. Two midline(epigastric and umbilical) and two lateral hernias (Spigelian and lumbar) are identifiable entities with distinct

localizations. Cutoff values of 2 and 4 cm were chosen to describe three subgroups according to size: small, medium and large.

A. Congenital Present at birth

1. Omphalocele
2. Gastroschisis
3. Umbilical- Infant

B. Acquired

1. Midline - Diastasis recti, Epigastric, Umbilical: Adult, Acquired, Paraumbilical
2. Median -Supravesical, Anterior, Posterior, Lateral
3. Paramedian - Spigelian, Interparietal, Preperitoneal, Interstitial, Superficial
4. Incisional- It depends on previous operative incision
5. Traumatic - Penetrating, Blunt, Destructive.

AETIO PATHOGENESIS:

The main causes for production of ventral hernia can be classified into congenital and acquired causes.

1. Congenital Causes: Congenital sac, apertures in the linea alba and aponeurosis or in linea semilunaris. The umbilicus is sometimes imperfectly developed at birth permitting the viscera to protrude through the umbilical cord. Congenital muscle defects.

2. Acquired Causes: The hernia may result from any condition which tends to weaken the abdominal wall or tends to increase

the intra-abdominal pressure. Post-operative incisional hernias may result from imperfect closure of peritoneum and anterior abdominal wall following laparotomy. Chronic strain (e.g. whooping cough in children, chronic Bronchitis constipation, urinary out flow obstruction in adults). Stretching and relaxation of abdominal musculature because of increase in size of contents e.g Obesity, Pregnancy

Obesity - Fat acts like a pile driver as it separates muscle bundles and layers, weakening aponeurosis and favors the outcome of hernia. Direct trauma- Blunt and penetrating injuries

EPIGASTRIC HERNIA:

Hernia occurring through the interlaying fibers of the lineaalba in the midline above the umbilicus. Small portion of extraperitoneal fat which when herniate are known as fatty hernia of lineaalba. The cause of epigastric hernia is unknown. But since it occurs in newborn children, is assumed to be the result of a structural congenital weakness of the line alba between xiphoid process and the umbilicus. It is possibly owing to a lack of fibers at the midline decussation, which allows preperitoneal fat to be herniated between the gaps. Common between 20 and 50 years. Moschowitz emphasized the importance of blood vessels perforating the lineaalba and prolongation of the transversalis fascia. Fibers originating from the diaphragm traverse the uppermidline aponeurosis posteriorly and join the fibers of the posterior rectus sheath and middle tendinous intersection. They attach to the lineaalba at a site midway between the xiphoid and umbilicus.

Uncoordinated vigorous, synchronous contraction of the diaphragm and upperabdomen may occur during straining and coughing. The force caused by upward traction on the diaphragm and lateral traction on the tendinous intersection would be maximal at this point of attachment midway between the xiphoid and the umbilicus, the most common site of Epigastric Hernia.

PARAUMBILICAL HERNIA:

Most common abdominal wall defects noted in infants and children. There is swelling of the umbilicus when the child cries, which is diagnostic of umbilical hernia. These are mostly symptomless. Obstruction and strangulation is extremely rare in these hernias. Etiological factors can be divided into congenital and acquired factors.

1. Congenital Due to anatomical weakness, mal-development of abdominal wall few variations in their attachment and arrangement of abdominal muscle. A positive relation between the pattern of aponeurotic decussating and herniation has been demonstrated by study conducted by Askar with a single midline decussating a midline hernia defect is seen. Congenital widening of the umbilical orifice predisposing factors.
2. Acquired
    a) Predisposing factors
        i. Faulty ligation of umbilical cord. Umbilical cord ligation more 4-5cm from the abdominalwall may give rise to development of hernia.
        ii. Umbilical sepsis- weakness of umbilical area.

iii. Increased intra-abdominal pressure, due to chronic cough, constipation, straining while passing urine, ascites.

iv. Direct trauma.

b) Contributing factors: Low birth weight, Race, Sex: Female: Male=3: 1, Family history. Age: more common in children< 2yrs and elderly people.

Obesity

a) Fat accumulated in the omentum, mesentry and sub peritoneal tissues, thus increasing the intra-abdominal tension.
b) Fat penetrates muscle bundles and layers, Weakens the aponeurosis and favors appearance of hernia.
c) Obesity causes downward traction on the abdominal wall bearing on a fixed point at umbilicus associated with an increase of vertical dimension of abdominal wall. This can be attributed to the theory explained by Mayo.

Multiparty due to stretching and weakening of anterior musculo aponeurotic layer

Associated conditions-some congenital condition like mongolism, cretinism, meningomyelocele, hurler's syndrome, and amourotic family idiocy may be associated with umbilical hernia. May be associated with cholelithiasis, abdominal malignancies, collagen disease, hemorrhoids, varicose veins, and cystocele.

INCISIONAL HERNIA:

Many factors, singly, or in various combinations, may cause failure of the wound to heal satisfactorily and may lead to the development of a post-operative hernia. The common causes are poor surgical technique and sepsis.

The causes are explained below;

1. Poor Surgical Technique

a) Non-anatomic incisions: Vertical para-rectus incision which destroys the nerve and vascular supply to the tissues medial to incision, causing them to atrophy.

b) Layered closures: These are followed by a greater incidence of post-operative hernias than are wounds closed by the single layer mass closure technique. This may be owing to the fact that many more sutures are used; which are closely placed, and because insufficiently sized bites of each thin layer are taken.

c) Inappropriate suture material: Wounds closed with non-absorbable suture material are followed by lower incidence of post-operative hernias than wounds closed with absorbable material. The ideal suture material for abdominal closure, especially of midline incision, in monofilament stainless steel wire used in the form of interrupted mass closure, taking large bites of the musculo-aponeurotic layers of the abdominal wall. A good alternative is mass closure with a continuous heavy (1 or metric 4) monofilament polyamide or polypropylene as a single thread or, preferably in the form of a commercially available loop.

d) Suturing Technique: Small sutures take only a small amount of tissues close to the cut edge of the incision, easily cut out of the tissues. A small, tightly tied suture causes ischemia ischemia and necrosis of the tissues it contain and also of an area on each side of the suture. Then these small, tightly tied sutures are placed close to each other, their ischemic areas merge and thus, cause necrosis of a strip of tissue all along the edge of the incision, which separates, together with the sutures, from the rest of the abdominal wall, leading to failure of the wound.

e)Tension: The lateral pull of the abdominal wall muscles against the suture reduces tension which tends to pull them in the opposite direction, creates an area of pressure necrosis where the suture meets the tissue.

2. Sepsis: It is the second major cause of early wound failure. It may range from frank acute cellulites, with fasciitis and necrosis of the tissues on each side of the incision, to low grade chronic sepsis around sutures such as silk. The infection causes inflammation and edema of the tissues, which becomes soft and weakened so that the sutures tear the tissues and pull out under the strain of intra-abdominal pressure.

3. Drainage tubes: The tissue planes along the track of the drain are not sutured, an open and weak passage is present through all layers of the wound through which a hernia may develop if drain tube are brought out through operation wound. Drain allows for two way traffic of secretions outwards and organisms inwards. The irritation caused by drain causes edema or

softening and tearing of the tissues and cutting out of the sutures. Drainage tubes are kept away from the primary incision with a separate incision.

4. Obesity: Obesity is associated with high percentage of post-operative hernias as well as repair of these hernias. Cutting through large masses of fat and the increased retraction needed may raise the infection rate in these patients and lead to recurrence tissues infiltrated with fat may not be able to hold the sutures, especially since the excess of intra and extra abdominal accumulation of many kg of fat may add enormous tension on the sutures. Obese patients tend to develop post-operative complications such as paralytic ileus, atelectasis, pneumonia and deep vein thrombosis that may increases the risk of incisional hernia.

5. General Condition: The general condition of the patient influences the rate of post-operative ventral hernia. The factors include age, generalized wasting, malnutrition and starvation hypoproteinemia (especially hypoalbuminemia); avitaminosis (especially vitamin C),malignant disease, anemia, jaundice, Diabetes mellitus, chronic renal failure, liver failureascites, prolonged steroid therapy, immuno-suppressive therapy and alcoholism.

6. Post-operative Complications: These include prolonged post-operative paralytic ileus,Intestinal obstruction with abdominal distension, chronic obstructive pulmonary disease,pulmonary collapse, bronchopneumonia, emphysema and asthma which increase the incidence of post-operative hernias.

7. Types of Operation: These include Laparotomy for generalized or localized peritonitis in patients with perforated peptic ulcer, appendicitis,

diverticulitis and acute pancreatitis. Operation for intra-abdominal malignant disease, inflammatory bowel disease, re-operation through the original wound, especially within the first six months after the initial procedures have tendency to be followed by hernia.

8. Tissue Failure: Hernia develops in what apparently is a perfectly healed wound that has functioned satisfactorily for five, ten or even more year and after operation and is presumably the result of the failure of the collagen in the scar, Rodriques has recently shown a decrease in OXYTALAN FIBERS and an increase in the amorphous substance of the elastic fibers as a function of age and may be responsible for alterations in the resistance of the transversals fascia and abdominal wall scar tissue. Ageing and weakening of the tissue and increased intra-abdominal pressure associated with chronic cough, constipation and prostatism are cited as factors.

RISK FACTORS

The development of INCISIONAL HERNIA is associated with a number of risk factors which may be related to patient, nature of the primary surgery and biological factors.

Patient related factors

- Age: more than 60 years;
- Gender: Male
- Obesity: BMI>25Kg/m2
- Co-morbidities: Diabetes mellitus,
  chronic lung diseases,
  obstructive jaundice,
  immuno suppression in organ transplant patients,
  Chemotherapy and Steroid therapy.

The old age and male gender are considered as risk factors because wound healing is delayed and collagen synthesis deceased beside the fact that the old age is the age of chronic diseases and malignancies.
Obesity, expressed as body mass index (BMI) is a major risk factor of IH.

A BMI>24.4kg/m2 is considered as one of the predicting factors fordeveloping IH, at 6 months after midline laparotomy.

Co-morbidities: Diabetes mellitus, jaundice,malignancies, chronic lung diseases, prostatism, chronic constipations, as well as heavy lifting are well known risk factors for hernia development by increasing the intra-abdominal pressure, delaying healing and delaying collagen synthesis. Immuno-supression in organ transplant patients increases the rate of wound infection, wound dehiscence and IH. Steroid therapy for certain chronic diseases or as a bolus therapy for immuno suppression in organ transplant patients and chemotherapy are risk factors of IH.

Surgery related factors

- Emergency operations
- Bowel surgery
- Abdominal aortic aneurism
- Stoma closure
- Operations for peritonitis
- Re-laparotomy
- Technique and suture material used for closure of the abdominal incisions.
- Wound infection
- Long operating time
- Increased blood loss
- Surgeon experience.

Emergency surgery increases the risk of IH as a result of post-operative complications, inadequate patient preparation, use of drains and the midline approach in the emergency operations. The nature of the surgical operation; operations in which there maybe wound contamination(bowel resection or secondary peritonitis), surgery for malignant tumours, abdominal aortic aneurysm, stoma closure, major abdominal surgeries and operations followed by open abdomen treatment with negative pressure and delayed primary wound closure, are all risk factors for development of IH . Selection of the site incision, suturematerials and the technique of closure of incision areimportant factors. Midline abdominal incision has a higher risk for developing IH compared to transverse and oblique incisions (11%, 4.7% and 0.7% respectively). The technique of closing the abdominal fascia and the suture material used play a major role in developing IH. Re-laparotomy is a strong risk factor. Also factors related to the surgeon experience, long operation time and increased blood loss increase the risk of IH. Wound infection and wound dehiscence are major risk factors for IH. This risk is more prominent after burst abdomen with evisceration. The 10-year cumulative risk for developing IH after wound dehiscence is 78% regardless of suture material and technique used. Murray (2911) reported an increase of IH by 1.9 fold after surgical site infection. Operation on the previously infected or the relatively avascular scar tissue increases the risk of IH.

Biological risk factors

- Collagen and metalloproteinase synthesis
- Smoking
- Nutritional deficiencies

The unchanged incidence of IH over the last decades can only be explained by the presence of biological factors which are individual dependent. These factors include: synthesis of different types of collagen,enzymes defects, smoking and some nutritional deficiencies. Defective collagen metabolism and synthesis is one of the major factors involved in the development of IH. Patients with IH have a reduced ratio of collagen I: collagen III as well as a reduced ratio of matrix metalloproteinase 1 (MMP1) to matrixmetalloproteinase2 (MMP2).These reductions in the synthesis of different types of collagen and enzyme play a role in the development of IH. Biological elements like copper and zinc are important for the integrity of collagen because they are necessary for the synthesis of the enzyme Laysyl oxidase which contribute in the integrity of the collagen molecule. The presence of other biological factors (Plasminogen activator inhibitor, urokinase ,plasminogen activator inhibitor) in the scar tissue may contribute in the development of IH . Smoking is a well known risk factor for hernia development. Smokers have four folds higher risk than non-smokers. Smoking can cause a peripheral tissue hypoxia which increases the risk of wound infection by reducing the oxidative killing mechanism of the neutrophils. Preoperative cessation of smoking reduces the rate of surgical site infection but not the rate of wound failure and hernia development.

PATHOGENESIS OF INCISIONAL HERNIA

- Incisional hernia occurs when the tissue structure and function is disturbed over a previous surgical scar.
- Two main biological mechanisms are involved in the pathogenesis of IH: primary fascial pathology and secondary wound failure over a surgical scar.
- The extra cellular molecular defect that develops after these two mechanisms leads to IH. Abnormal collagen metabolism, enzymes deficiency or excessive syntheses are the early mechanisms that are involved in the development of IH. Acquired collagen defect is related to smoking and nutritional deficiencies.
- The fascial pathology secondary to wound failure is due to formation of the scar tissue and to the defects in the function of the fibroblasts and collagen structure. Wound failure and loss of the normal healing process induces appearance of abnormal fibroblasts that leads to abnormal collagen, because fibroblasts are the main source of collagen synthesis.
- Straining during coughing, heavy lifting, abdominal distention and ascites can induce secondary changes on tissue fibroblasts.
- Wound ischemia due to intra operative shock, closure under undue tension or in the avascular scar tissue leads to defective tissue repair. Obesity increases the intra-abdominal pressure, but the exact mechanism by which obesity causes IH is not well defined, a mechanical stress could be the cause.

- The consequences of the abnormal collagen metabolism are delayed and defective collagen synthesis and an increase in the activity of the protease enzymes at the level of the wound which increases collagen degradation. The end result is a decrease in type I and type III collagen, a decreased ratio of collagen I to collagen III.
- The reduction of the collagen synthesis and wound tensile strength increases the risk of the mechanical wound failure. Other factors that contribute to the quantitative and qualitative wound failure include: inadequate haemostasis that results in haematoma formation with its mechanical disruption effect on the surgical wound, delayed or defective inflammatory response that results in wound contamination and hence prolongation of the transition to the proliferative phase of healing and delayed fibroblast response that in turn leads to delaying in synthesis of wound matrix.
- Following wound infection, multiplication of bacteria in the wound affects the process of healing which results in a decreased and defective collagen synthesis. This defective collagen synthesis leads to wound dehiscence and late IH development. Smoking apart from reducing the oxidative killing mechanism of neutrophils, it can also decrease collagen synthesis and produces a decrease in collagen I to collagen III ratio.
- Smoking also increases the degradation of the connective tissue as a consequence of enhancing the imbalance between protease activity and their inhibitors. Acute tissue hypoxia caused by smoking leads to tissue necrosis in the fragile tissues of the wound. The postulation that IH is developed as a result of multiple biological factors action is

raised after the failure of reducing the incidence of IH by other non-biological measures.

CLINICAL FEATURES

These hernias commonly appear as a localised swelling involvinga small portion of the scar but may present as a diffuse bulging of the whole length of the incision. There may be several discrete hernias along the length of the incision and unsuspected defects are often found at operation. Incisional hernias tend to increase steadily in size with time. The skin overlying large hernias may become thin and atrophic so that peristalsis may be seen in the underlying intestine. Vascular damage to skin may lead to dermatitis. Attacks of partial intestinal obstruction are common as there are usually coexisting internal adhesions. Strangulation is less frequent and most likely to occur when the fibrous defect is small and the sac is large. Most incisional hernias are broad-necked and carry a low risk of strangulation.

The features are

- Swelling in the scar region.
- Pain.
- Impulse on coughing.
- Gurgling sound.
- Often bowel peristalsis may be visible under the skin.
- Features of irreducibility, obstruction, strangulation is seen.
- Hernia is common in lower abdomen.
- It may be small or large; huge or massive (diffuse).

- Scar, its extent and location, whether healed primarily or secondarily, skin over the scar and swelling is noted. Details of the swelling with expansile impulse on coughing and examination both in lying down and standing are done.
- Gap cannot be assessed in an irreducible hernia.

COMPLICATIONS OF INCISIONAL HERNIA

- Irreducibility
- Obstruction
- Strangulation
- Incarceration

SEVERITY CLASSIFICATION

There is no simple mechanism for communicating the complexity of ventral incisional hernia. Defect size, location on the abdominal wall, loss of domain, patient co morbidities, presence of contamination, necessity for an ostomy, acuity of the presentation, and history of prior repairs with or without a prosthetic allow an infinite number of permutations. The absence of a universal classification system has hindered comparisons within the literature and at meetings, indirectly delaying meaningful conversations about repair techniques and prosthetic choice. The TNM model for cancer staging is an enviable model to strive for in hernia repair. As such, a recent group sought to stratify ventral hernias into stages using a limited number of preoperative variables to accurately predict the two most

meaningful surgical outcomes: surgical site occurrence (SSO) and long-term hernia recurrence rates. Two of the most popular ventral hernia classification tools to date have been generated from expert opinion: the Ventral Hernia Working Group grading scale and the European Hernia Society system. The Ventral Hernia Working Group grading scale uses patient co morbidities and wound class to predict SSO risk. The European Hernia Society system assesses hernia width and location; it was initially designed to gather data on recurrence risk.

Using data from 333 ventral hernia repairs with no filter for technique, investigators presented a multivariate analysis that identified hernia width (<10 cm, 10 to 20 cm, ≥20 cm) and the presence of contamination as the two variables associated with wound morbidity (SSO) and hernia recurrence. Hernia location and patient co morbidities were not significant in this model for either outcome measure. Hernias could be grouped into stages (I to III) using width and wound class alone with ordinal increments in both outcome measures. Stage I hernias are smaller than 10 cm/clean and associated with low SSO and recurrence risk. Stage II hernias are 10 to 20 cm/clean or smaller than 10 cm/contaminated and carry an intermediate risk of SSO and recurrence. Stage III hernias are either 10 cm and larger/ contaminated or any hernia 20 cm or larger, and these are associated with high SSO and recurrence risk. The staging system is simple but comprehensive in its ability to stratify patients by risk of wound morbidity and recurrence, the two chief outcome parameters of repair. Importantly, this system does not include intra operative details, such as approach (open versus laparoscopic), mesh choice (biologic versus synthetic), or mesh position (onlay versus sublay). It is hoped that this platform can be the basis of future inclusion and exclusion criteria for studies regarding technique.

INCISIONAL HERNIA STAGING

STAGE I Risk: low recurrence, low SSO	<10 cm, clean
STAGE II Risk: moderate recurrence, moderate SSO	<10 cm, contaminated 10-20 cm, clean
STAGE III Risk: high recurrence, high SSO	≥10 cm, contaminated Any ≥20 cm

SSO –Surgical Site Occurrence

SURGICAL SITE OCCURRENCE AND RECURRENCE RATES

	SSO RATE	RECURRENCE RATE
STAGE I Risk: low recurrence, low SSO <10 cm, clean	7/77 (10%)	7/77 (10%)
STAGE II Risk: moderate recurrence, moderate SSO <10 cm, contaminated 10-20 cm, clean	30/151 (20%)	22/151 (15%)
STAGE III Risk: high recurrence, high SSO ≥10 cm, contaminated Any ≥20 cm	44/105 (42%)	27/105 (26%)

SSO –Surgical Site Occurrence

INVESTIGATIONS

- Chest X-ray
- USG abdomen
- Tests relevant for causes

Preoperative Preparations for Incisional Hernia Surgery

- Reduction in weight and control of obesity.
- Nutrition, control of anaemia.
- Treatment for diabetes, hypertension, cardiac diseases,respiratory problems.
- Treating the precipitating causes.
- Chest X-ray, U/ S abdomen to be done.
- Massive incisional hernia after reduction might cause IVCcompression, paralytic ileus and diaphragmatic elevationwith respiratory embarrassment (*abdominal compartmentsyndrome*). It is prevented by prior increasing the capacityof peritoneal cavity by creating pneumo-peritoneum usingCO2 so as to increase the peritoneal pressure by 12-15cm of H2O, daily for 3-6 weeks. Later definitive surgeryis done.

TREATMENT

Asymptomatic incisional hernias may not require treatment at all. The wearing of an abdominal binder or belt may prevent the hernia from increasing in size.

Principles of surgery

For the majority of incisional hernias, surgery is relatively straight forward and both open and laparoscopic options are available. A number of principles apply, irrespective of the technique used. The repair should cover the whole length of the previous incision. Approximation of the musculofascial layers should be done with minimal tension and prosthetic mesh should be used to reduce the risk of recurrence. Mesh may be contraindicated in a contaminated field, e.g. bowel injury during the dissection but, in a clean-contaminated field, such as after an elective bowel resection, mesh may be used if placed in a different anatomical plane to the contamination, such as in the extraperitoneal/retromuscular space. Appropriate systemic antibiotics should be used.

Open repair

Simple suture techniques without the use of prosthetic mesh for reinforcement, even with layered closure such as in Mayo, 'keel' or da Silva repairs, are not recommended today because of the high risk of recurrence. However, they may be the only option in the presence of gross contamination such as peritonitis.The previous incision is opened along its full length to reveal any clinically unsuspected defects. The hernial sac, its neck and the margins of the defect are fully exposed. The sac can be opened, contents reduced, local adhesions divided and any redundant sac excised to allow safe reclosure of the peritoneum. Mesh can be placed in one of several planes as for umbilical hernia repair. The simplest approach is an onlay mesh but increasingly the retromuscular sublay repair is preferred by expert surgeons and is described below.

Retromuscularsublay mesh repair

Vertical incisons are made through the fascia surrounding therectus abdominus muscles so that the muscle can be separated and elevated from the posterior rectus sheath below. If possible, the medial edges of the posterior rectus sheath edges are sutured together with a continuous suture. In very large defects this may not be possible and below the arcuate line, the posterior sheath is deficient, being peritoneum and transversalis fascia only. In the case of transverse incision, where the defect extends lateral to the rectus sheath, internal oblique and transverses abdominis muscles form the posterior layer. A sheet of lightweight, large poreprosthetic, elastic mesh is then laid between this posterior rectus sheath and belly(s) of the rectus muscle. It is fixed to the sheath by interrupted sutures. The mesh must be large enough to ensure 5 cm overlap of the underlying fascial defect in all directions. Careful haemostasis and meticulous asepsis are essential during this operation. The anterior rectus sheaths are then sutured together over the mesh so that, ideally, the mesh is completely covered by muscle and fascia and is not lying in the subcutaneous plane. Redundant skin may need to be excised. The risk of postoperative serous fluid collections is reduced by suction drainage.

Laparoscopic repair

Incisional hernias are increasingly being repaired by laparascopic mesh techniques. Laparoscopy and division of adhesions is initially performed. Hernia contents are reduced and the fibrous margins of the hernia defect(s) are exposed. Often the falciform ligament and median umbilical fold need to be taken down. Some surgeons prefer to suture close the muscle defects first and then reinforce with mesh. Others simply fix the mesh under the defect with adequate overlap. The use of a tissue-separating mesh is essential. Various techniques have been described to size and then position the mesh accurately. The mesh is fixed to the abdominal wall by staples or trans fascial sutures which pass through all muscle layers to hold the mesh. In the presence of dense peritoneal adhesions, the laparoscopic surgeon needs to take great care as injury to bowel is possible and may not be recognised. Diathermy is not used. If occult bowel injury does occur it can lead to postoperative peritonitis which is an extremely dangerous complication.

Management of the very large incisional hernia

Very large incisional hernias often require careful thought before treatment begins. If the volume of the sac is more than 25 per cent of the volume of the abdominal cavity (and this can be calculated from CT scan images) then there are likely to be issues of loss of abdominal domain when the hernia is repaired. The contents of the hernia, which have been outside the abdominal cavity for a long time, will not fit back inside, or if they do, it will result in high tension. High intra-abdominal pressure can lead to visceral compression and pulmonary complications due to impaired diaphragmatic movement. A tight abdomen can lead to wound breakdown and failure of the repair. Techniques to overcome the potential loss of abdominal domain include preoperative abdominal expansion with progressive preoperative pneumoperitoneum over several weeks, resection of the omentum and/or colon at the time of repair,the use of prosthetic mesh to span the uncloseable gap in the musculofascial layer, or the use of musculofascial advancement or transposition flaps to achieve closure. Even if loss of domain is not a concern, large defects can still be very difficult to close and the same special techniqes may need to be used to avoid producing excessive tension in the repair. The Ramirez component separation technique, which incorporates relaxing incisions in the external oblique aponeurosis and/or the posterior sheath, is very useful as this enables either the anterior or posterior component of the rectus sheath to be drawn together. It may then be reinforced with a mesh. Patients with poor quality or redundant skin may benefit from a wedge excision of skin and fat (lipectomy) to improve the abdominal contour postoperatively. Repair of

these very large hernias is highly specialised surgery and is best done in specialist centres.

Reducing the risk of incisional hernia

The incidence of incisional hernia may be reduced by improving the patients' s general conditon preoperatively where possible – e.g. weight loss for obesity, or improving nutritonal state for malnutrition. Closing the fascial layers with non-absorbable, or very slowly absorbable, sutures of adequate gauge is important. Traditional teaching was that sutures should be 1 cm deep and 1 cm apart. Recent work has shown that lower incisional hernia rates and reduced infection rates are gained when smaller and closer bites are used with a 2/0 suture rather than traditional heavier materials. There is no evidence that interrupted sutures are better or worse than continuous. However, if continuous suturing is used, the tissue bites must not be too near the fascial edge nor pulled too tight or they may cut out. It has also been confirmed that the optimal ratio of suture length to wound length is 4: 1 (Jenkins' rule). If less length than this is used, the suture bites are too far apart or too tight and the converse applies if more length than this is used. Drains should be brought out through separate incisions and not through the wound itself as this leads to hernia formation. Recent reports have suggested that placement of a prophylactic mesh in patients at high risk of hernia formation will substantially reduce that risk. This has been reported in obese patients undergoing bariatric surgery and also to prevent parastomal herniation which occurs in up to 50 per cent of patients.

POSTOPERATIVE CARE

- Antibiotics
- Analgesics
- Nasogastric aspiration
- Abdominal binder for support
- Prevention of paralytic ileus
- Control of obesity and other precipitating factors
- Stop smoking and treat other associated causes
- Early ambulation
- Fluid management, catheterisation
- Drain should be kept until drainage becomes minimal
- Abdominal binder is used to support abdominal wall during recovery period.

COMPLICATIONS OF INCISIONAL HERNIA SURGERY

- Wound infection, seroma formation
- Paralytic ileus, abdominal compartment syndrome in large hernias
- Wound sinus, entero cutaneous fistula
- Infection of the mesh, recurrence

MATERIALS AND METHODS

MATERIALS AND METHODS

STUDY DESIGN:

Prospective comparative analytical study

SOURCE OF DATA:

The data is obtained from patients who consented to get operated for Incisional Hernia at Madras Medical College and Rajiv Gandhi Government General Hospital, Chennai-600003.

PERIOD OF STUDY:

February 2017 to September 2017(8 months)

INCLUSION CRITERIA:

- Patient who give informed written consent
- All patients with Incisional Hernia between 18 to 70 years
- Both the sexes

EXCLUSION CRITERIA:

- Patient unfit for surgery
- Recurrent Incisional Hernia
- Emergency surgery for Incisional Hernia
- Pregnancy with Incisional Hernia

SAMPLE SIZE:

50 patients

OBJECTIVES OF THE STUDY

- To evaluate the risk factors associated with Incisional Hernia.
- To develop a strategy for an effective management of Incisional Hernia by studying the outcomes of various techniques in the incisional hernia repair.
- To study the post-operative morbidity of various surgical techniques.

PROCEDURE:

Data will be collected in a specially designed case recording Proforma (CRF) pertaining to patient's particulars, proper history, clinical examination, investigations, diagnosis & surgical procedures. It is then subjected to statistical analysis with the help of biostatistician of our institute. All the surgical procedures & medical management and investigations will be conducted under direct guidance and supervision of our guide. Before the start of our study a written/informed consent will be obtained in local vernacular language from each patient.

METHODOLOGY

Preoperative Evaluation

All the patients are evaluated by proper history and detailed physical examination. Data collected by proforma. All patients underwent routine blood investigations and in our study. Ultrasound abdomen done for all our patients to know the size, number of defects, contents and any other abdominal Pathology.

Preoperative preparation

Patients kept NPO for about 6 to 8 hours. All patients received prophylactic antibiotics half an hour before surgery.

Patient position

Patient is in supine position without any tilt.

Position of surgical team

The operating surgeon stands to the right of the patient with the assistant on his left.

Procedure for open surgery

Almost all patients are operated under general anaesthesia. Foley's catheterization and naso gastric tube used. Patients were placed in supine position skin incision was made according to the site and size of the defect. The hernia sac was detected out and reduced and the defect assessed. When there where adhesions, sac was opened and contents were reduced. In onlay repair polypropylene mesh is sutured over the anterior rectus sheath, while in sublay technique mesh is placed under retro-rectus muscle position. Suction drain was placed, skin and subcutaneous tissue closed in layers.

Mesh used

Polypropylene mesh

Post-operative

During post-operative period, all patients received intravenous aqueous diclofenac injections 12th hourly for 1 day unless contraindicated and there after oral analgesics are given on the patient demand. All the patients are ambulated within 12 hours of surgery and are encouraged for oral feeds. Initially the feeds were sips of liquids followed by normal diet after the resolution of post-operative ileus (indicated by passing of flatus and normal bowel sounds on auscultation and return of appetite). In patients with persistent ileus, they were kept NPO and whenever required a nasogastric tube is passed only to be removed with resolution of ileus. The wounds were inspected for any seroma, hematoma or any infections. In open group, drains were removed when the collection was less the 30 ml for 2 consecutive days. Patients were discharged after complete ambulation and tolerating normal diet.

OBSERVATION AND ANALYSIS

OBSERVATION AND ANALYSIS

All the collected data were tabulated on MS Excel sheet. For the categorical and continuous data, the calculations were denoted by numbers and percentage of the total and mean ± S.D. respectively.

Chi-square/ Fisher Exact test has been used to find the significance of the study parameters on categorical scale between two or more groups.

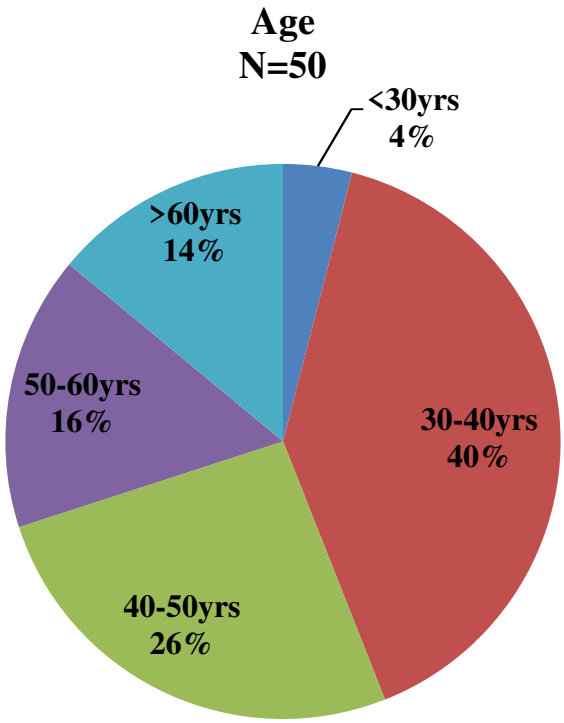
Significant Figures:

- Suggestive significance (P value: $0.05<P<0.10$)
- Moderately significant (P value: $0.01<P\leq0.05$)
- Strongly significant (P value: $P\leq0.01$)

Statistical software:

The Statistical software namely SAS 9.3, SPSS 15.0 were used for the analysis of the data and Microsoft Word and Excel have been used to generate graphs, tables etc.

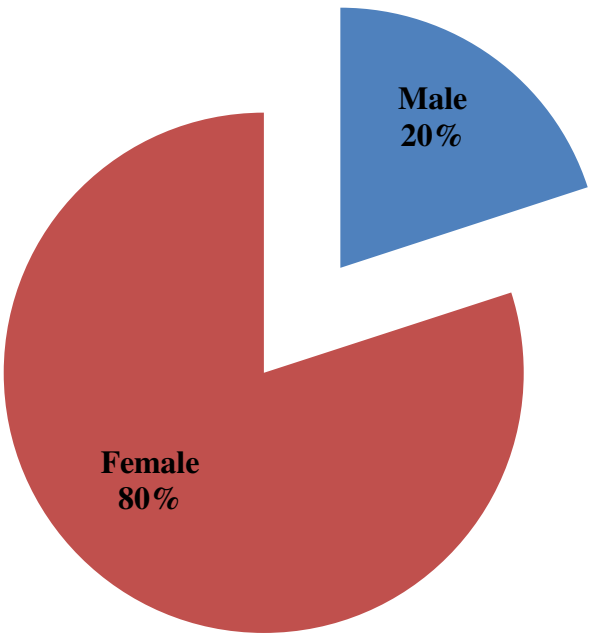
AGE AT INCISIONAL HERNIA REPAIR DONE



AGE	NO OF PATIENTS
<30yrs	2
30-40yrs	20
40-50yrs	13
50-60yrs	8
>60yrs	7
Total	50

In our study, most of the patients more than 60%, underwent incisional hernia surgery between the age of 30 to 50 years. Of these, most of the patients are in the age group of 30 to 40 years. This shows most of the patients are in the middle age group.

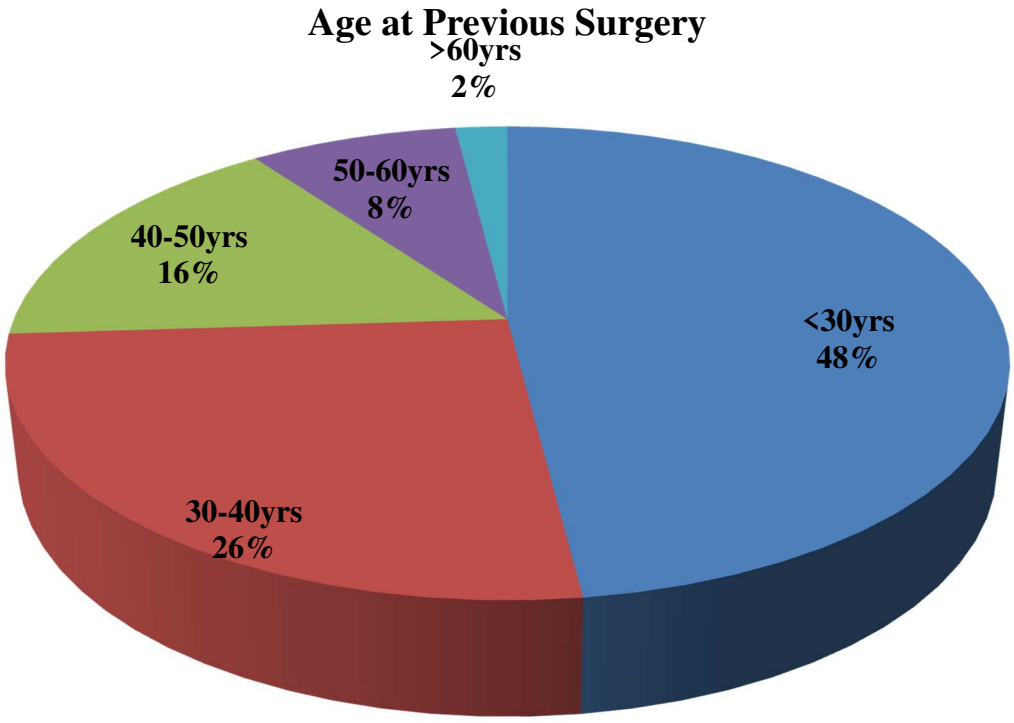
GENDER DISTRIBUTION



GENDER	NO OF PATIENTS
Male	10
Female	40

In our study, out of the fifty patients in incisional hernia repair, 10 patients (20%) are male. While 40 patients (80%) are female. This shows females are more prone for incisional hernia.

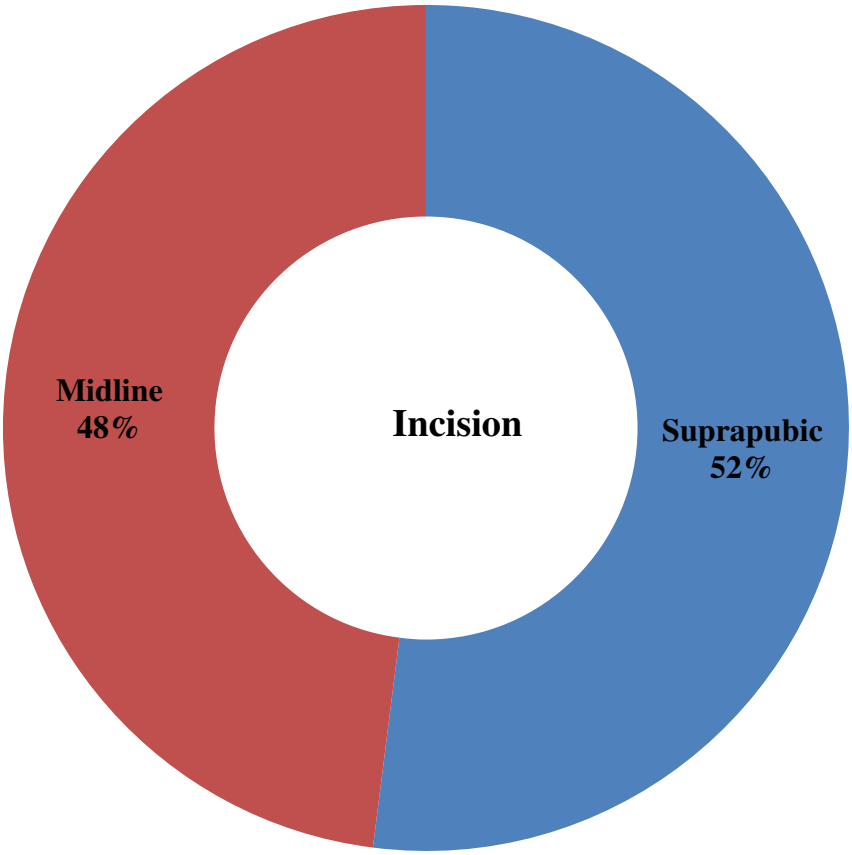
AGE OF PREVIOUS SURGERY



AGE	NO OF PATIENTS
<30yrs	24
30-40yrs	13
40-50yrs	8
50-60yrs	4
>60yrs	1
Total	50

In our study, most of the patients undergone previous surgery under the age of 30 years (48%). 13 patients (26%) were between the 30 to 40 years of age. The rest 13 patients (26%) were above 40 years of age. This shows that the patients undergone surgery in young age group are prone for incisional hernia.

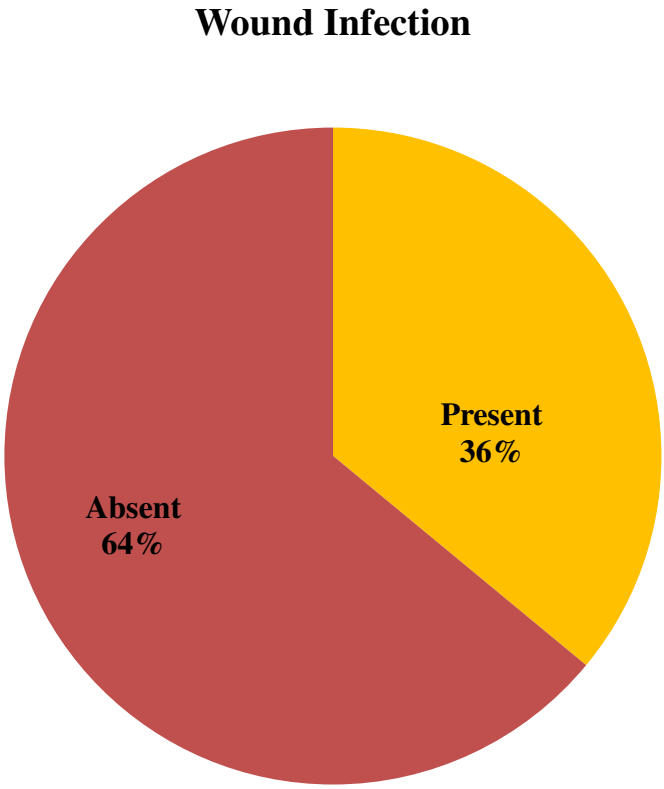
TYPE OF INCISION IN PREVIOUS SURGERY



INCISION	NO OF PATIENTS
Suprapubic	26
Midline	24

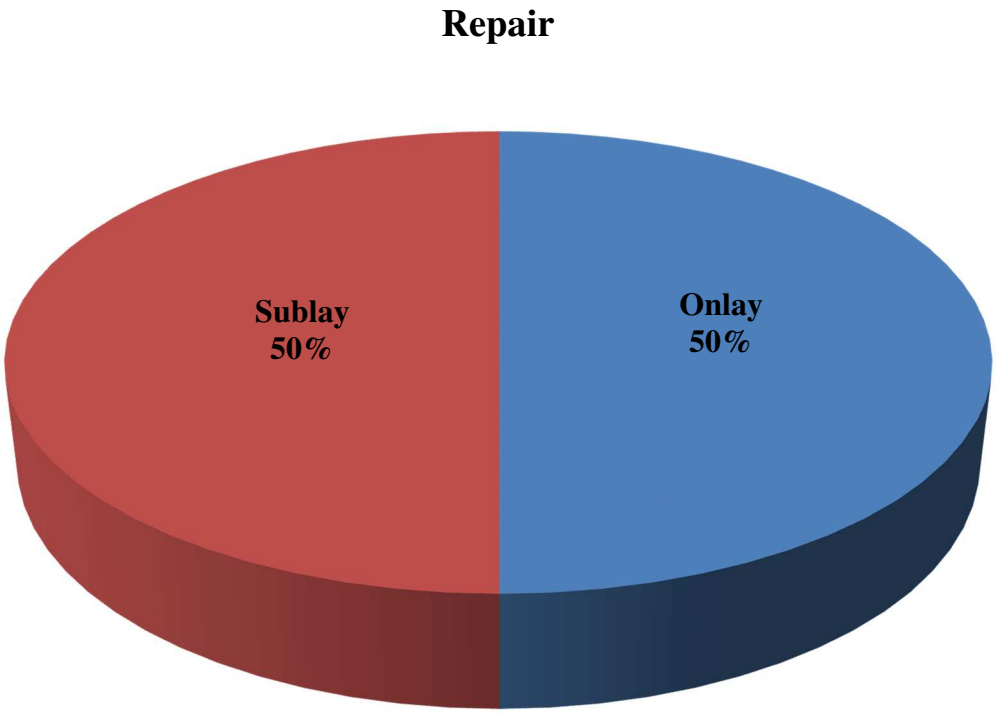
During previous surgery, Suprapubic incision was done for 26 patients (52%) and Midline incision for 24 patients (48%). This shows that all the incisions in abdominal wall prone for incisional hernia without much difference.

WOUND INFECTION IN PREVIOUS SURGERY



Many of the patients are having history of previous wound infection in previous surgery noted in our study.

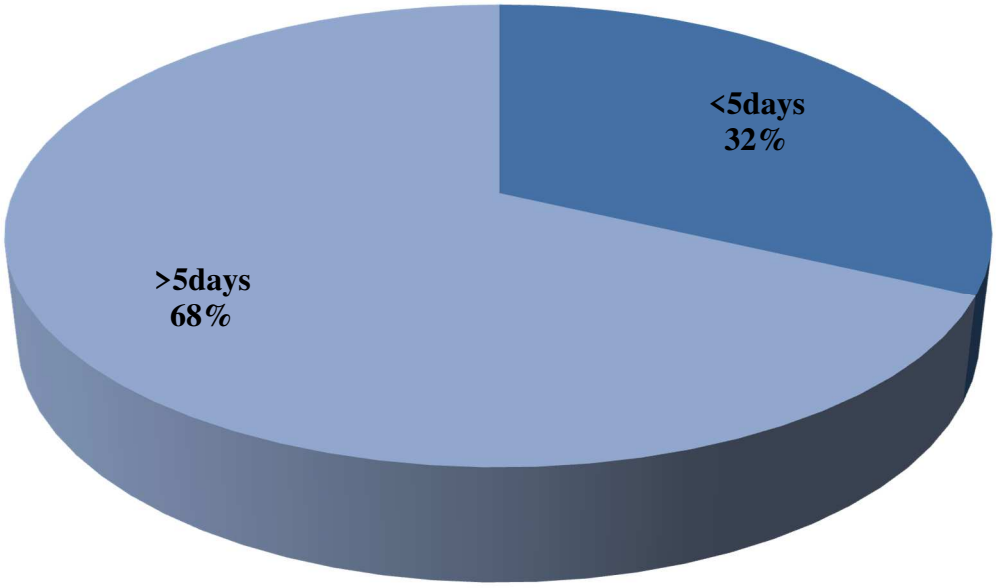
TYPE OF INCISIONAL HERNIA REPAIR DONE



REPAIR	NO OF PATIENTS
Onlay	25
Sublay	25

DRAIN REMOVAL

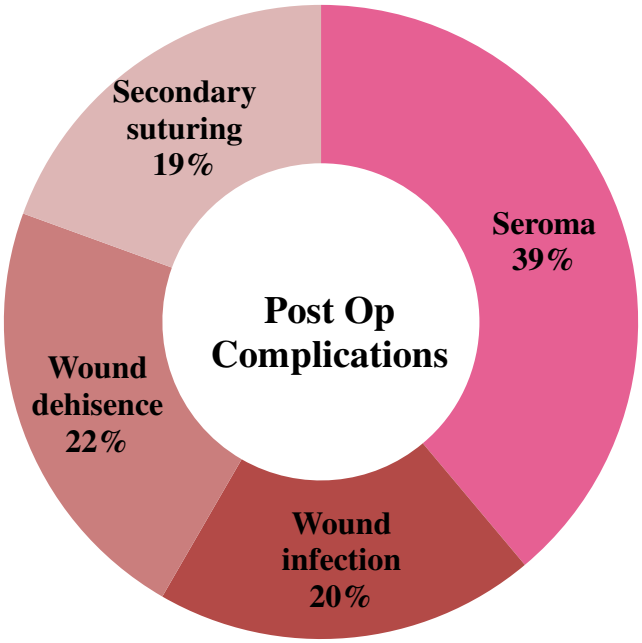
Drain Removal



DRAIN REMOVAL	NO OF PATIENTS
<5days	16
>5days	34

Drain removal was done after five days for 34 patients (68%) and within five days for 16 patients (32%). This shows duration of stay increased in onlay mesh repair due to delayed drain removal.

POST-OPERATIVE COMPLICATIONS OF INCISIONAL HERNIA REPAIR



POSTOP COMPLICATIONS	ONLAY	SUBLAY	TOTAL PATIENTS	PERCENTAGE
SEROMA	11	3	14	39.0%
WOUND INFECTION	6	1	7	20.0%
WOUND DEHISENCE	7	1	8	22.0%
SECONDARY SUTURING	6	1	7	19.0%

In the present study, post-operative complications of onlay and sublay compared. Seroma rate is 39%, wound infection is 20%, wound dehiscence is 22%, secondary suturing done in 19% of the patients. From this, sublay repair is having minimal number of complications.

SEROMA

		SEROMA		Total	P-value
		ABSENT	PRESENT		
REPAIR	ONLAY	14	11	25	0.012(S)
	SUBLAY	22	3	25	
Total		36	14	50	

WOUND INFECTION

		WOUND INFECTION		Total	P-value
		ABSENT	PRESENT		
REPAIR	ONLAY	19	6	25	0.042(S)
	SUBLAY	24	1	25	
Total		43	7	50	

WOUND DEHISENCE

		WOUND DEHISENCE		Total	P-value
		NO	YES		
REPAIR	ONLAY	18	7	25	0.021(S)
	SUBLAY	24	1	25	
Total		42	8	50	

SECONDARY SUTURING

		SECONDARY SUTURING		Total	P-value
		NO	YES		
REPAIR	ONLAY	19	6	25	0.042(S)
	SUBLAY	24	1	25	
Total		43	7	50	

DISCUSSION

DISCUSSION

The standard procedure for incisional hernia is implantation of prosthetic mesh. Various studies have concluded that mesh repair is superior to suture repair which has 85 % higher recurrence risk compared to mesh repair. This can be done using various techniques like onlay mesh repair, sublay mesh repair and laparoscopic mesh repair. The onlay technique involves primary closure of the fascial defect and subsequent reinforcement by placing the prosthetic mesh on top of the fascial repair and securing the mesh to anterior rectus sheath with sutures or facial staplers. The major advantage is that the mesh is separated well away from the intra-abdominal contents reducing complications. This technique has several disadvantages like extensive dissection of subcutaneous plane which leads to seroma collection, mesh infection in superficial wound breakdown, primary repair under tension and, hence, the presence of a more risk of recurrence.

The sublay technique includes the placement of prosthetic mesh being placed preperitoneally in the recto-rectus muscle space. This preperitoneal technique has less recurrence rate and postoperative wound complications as supported by a study from a randomised, controlled trial which showed that onlay technique was associated with five times higher recurrence rates and twice the rate of postoperative wound complications when compared with placing the mesh in an sublay fashion.

In our study, most of the patients more than 60%, underwent incisional hernia surgery between the age of 30 to 50 years. Of these, most of the patients are in the age group of 30 to 40 years. This shows most of the patients are in the middle age group.

In our study, out of the fifty patients in incisional hernia repair, 10 patients (20%) are male. While 40 patients (80%) are female. This shows females are more prone for incisional hernia.

In our study, most of the patients undergone previous surgery under the age of 30 years (48%). 13 patients (26%) were between the 30 to 40 years of age. The rest 13 patients (26%) were above 40 years of age. This shows that the patients undergone surgery in young age group are prone for incisional hernia.

Many of the patients are having history of previous wound infection in previous surgery noted in our study.

Drain removal was done after five days for 34 patients (68%) and within five days for 16 patients (32%). This shows duration of stay increased in onlay mesh repair due to delayed drain removal.

In the present study, post-operative complications of onlay and sublay compared. Seroma rate is 39%, wound infection is 20%, wound dehiscence is 22%, secondary suturing done in 19% of the patients. From this, sublay repair is having minimal number of complications.

CONCLUSION

CONCLUSION

A study consisting of 50 patents who underwent incisional hernia repair by onlay and sublay method in Madras Medical College and evaluating outcomes of onlay and sublay surgical techniques in Madras Medical College, preperitoneal sublay repair was found to have better patient compliance and satisfaction with regard to occurrence of complications. The preperitoneal sublay repair procedure can easily be performed by a surgeon with proper guidance and has a short learning curve.

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PROFORMA

Name:

Age :

Sex :

IP No :

DOA :

Complaints :

Duration:

Chronic cough

Constipation

Past history: DM/HT/ASTHMA/STEROID USE/HIV

General examination:

Anemia

Icterus

Weight

Height

BMI

Operative history:

Age at surgery done

Type of surgery

Incision

Post op events:

- Wound infection
- Seroma
- Wound dehiscence
- Use of drain
- Secondary suturing

Current procedure

- Size of defect
- Type of repair
- Post op morbidity
    - Pain
    - Wound infection
    - Wound gaping
    - Abdominal distension
    - Cough
    - Constipation
    - Duration of hospital stay

INFORMATION SHEET

TITLE:

" STUDY OF INCISIONAL HERNIA – EVALUATION OF RISK FACTORS AND OUTCOME OF VARIOUS SURGICAL TECHNIQUES USED IN THE INCISIONAL HERNIA REPAIR "

Name of Investigator : Dr.R. Karthikeyan.

Name of Participant:

Purpose of Research: To study about causative factors and method of repairs and its outcome

Study Design **:** Prospective comparative analytical Study

Study Procedures **:** Patient will be subjected to routine investigations, Usg, complete hemogram, as indicated, and the data analysed

Possible Risks **:** No risks to the patient

Possible benefits

To patient : A better understanding of their problem so has to devise a plan of management which suits their needs.

To doctor & to other people: If this study gives positive results, it can help determine the role of various surgical techniques in incisional hernia repair. This will help in providing better and complete treatment to other patients in future.

Confidentiality of the information obtained from you: The privacy of the patients in the research will be maintained throughout the study. In the event of any publication or presentation resulting from the research, no personally identifiable information will be shared

Can you decide to stop participating in the study: Taking part in this study is voluntary. You are free to decide whether to participate in this study or to withdraw at any time

How will your decision to not participate in the study affect you: Your decision will not result in any loss of benefits to which you are otherwise entitled.

Signature of Investigator Signature of Participant

PATIENT CONSENT FORM

Study Detail : ***"STUDY OF INCISIONAL HERNIA – EVALUATION OF RISK FACTORS AND OUTCOME OF VARIOUS SURGICALTECHNIQUES USED IN THE INCISIONAL HERNIA REPAIR"***

Study Centre : Rajiv Gandhi Government General Hospital, Chennai.

Patient's Name :

Patient's Age :

Patient may check (☑) these boxes

I confirm that I have understood the purpose of procedure for the above study. I have the opportunity to ask question and all my questions and doubts have been answered to my complete satisfaction. ❑

I understand that my participation in the study is voluntary and that I am free to withdraw at any time without giving reason, without my legal rights being affected. ❑

I understand that sponsor of the clinical study, others working on the sponsor's behalf, the Ethics committee and the regulatory authorities will not need my permission to look at my health records, both in respect of current study and any further research that may be conducted in relation to it, even if I withdraw from the study I agree to this access. However, I understand that my identity will not be revealeds in any information released to third parties or published, unless as required under the law. I agree not to restrict the use of any data or results that arise from this study.

❑

I agree to take part in the above study and to comply with the instructions given during the study and faithfully cooperate with the study team and to immediately inform the study staff if I suffer from any deterioration in my health or well being or any unexpected or unusual symptoms. ❑

I hereby consent to participate in this study ❑

I hereby give permission to undergo complete clinical examination and diagnostic tests including hematological, biochemical, radiological tests and to undergo treatment ❑

Signature/thumb impression Signature of Investigator

Patient's Name : Study Investigator's Name: Dr.R. Karthikeyan

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ஆய்வில் பங்கேற்பவர்கான தகவல் அறிக்கை

ஆய்வின்தலைப்பு :

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பங்குகொள்பவரின் பெயர் :

ஆய்வு செய்பவரின் பெயர் : மரு. ரா. கார்த்திகேயன்.

இடம் : ராஜீவ்காந்தி அரசு பொது மருத்துவமனை, சென்னை – 600003

இந்த ஆராய்ச்சி / ஆய்வு / செய்முறை / சோதனையில் தாங்கள் பங்கேற்க அழைக்கிறோம். இந்த தகவல் அறிக்கையில் கூறப்பட்டிருக்கும் தகவல்கள் தாங்கள் இந்த ஆராய்ச்சியில் பங்கேற்கேலமா வேண்டாமா என்பதை முடிவு செய்ய உதவியாக இருக்கும். இந்த படிவத்தில் உள்ள தகவல்கள் பற்றி உள்ள சந்தேகங்களை நீங்கள் தயங்காமல் கேட்கலாம்.

ஆய்வின் நோக்கம்:

வெட்டுசார் குடலிறக்கம் ஏற்பட காரணமான ஆபத்து காரணங்களை ஆராய்தல்.

வெட்டுசார் குடலிறக்கம் சரி செய்வதற்கு உண்டான அறுவை சிகிச்சை முறைகளில் சிறந்த முறையை கண்டறிவதற்காக மற்றும் வெட்டுசார் குடலிறக்கத்தை சரி செய்யும் அறுவை சிகிச்சை முறைகளில் குறைந்த மருத்துவமனை சிகிச்சை தேவைப்படும் முறையை கண்டறிதல்.

ஆய்வுமுறைகள் :

விரிவான நோய்க் குறிப்புகளும் மருத்துவ பரிசோதனைகளும் செய்யப்படும். நோயாளிகள் அவர்கள் சம்மதத்திற்கு பின் அவர்களுக்கு தேவையான அறுவை சிகிச்சை செய்யப்பட்டு அதன் பலாபலன் மற்றும் பின் விளைவுகள் ஆராயப்படும்.

ஆய்வினால் மக்களுக்கு ஏற்படும் நன்மைகள்:

இந்த ஆய்வின் முடிவில் கிடைக்கும் தகவல்கள் சமுதாயதிற்கு பயனுள்ளதாகவும், எதிர்காலத்தில் நோயாளிகளுக்கு மருத்துவ தீர்வாகவும் அமையும்.

தங்களிடமிருந்து பெறப்படும் தகவல்களின் நம்பிகத்தன்மை:

தங்களிடமிருந்து பெறப்படும் தகவல்கள் பாதுகாக்கப்படுவதற்கான முழு உரிமையும் தங்களுக்கு உண்டு.

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S NO	NAME	AGE	SEX	ETIOLOGY				DEFECT SIZE	REPAIR	DRIAN REMOVAL	POST OP COMPLCATIONS			
				AGE AT SURGERY	TYPE OF SURGERY	INCISION	WOUND INFECTION				SEROMA	WOUND INFECTION	WOUND DEHISENCE	SECONDARY SUTURING
1	VEDHAMANI	38	F	23	LSCS	SUPRAPUBIC	ABSENT	5.9	ONLAY	8	ABSENT	ABSENT	NO	NO
2	KALAIYARASI	45	F	24	LSCS	SUPRAPUBIC	ABSENT	4.2	SUBLAY	3	ABSENT	ABSENT	NO	NO
3	MALLIGA	58	F	28	STERLISATION	SUPRAPUBIC	PRESENT	3.5	ONLAY	6	ABSENT	ABSENT	NO	NO
4	JANAKI	57	F	51	LAPAROTOMY	MIDLINE	ABSENT	7.4	SUBLAY	4	ABSENT	ABSENT	NO	NO
5	SELVI	37	F	33	STERLISATION	SUPRAPUBIC	ABSENT	2.9	ONLAY	7	ABSENT	ABSENT	NO	NO
6	YAMUNA	61	F	45	LAPAROTOMY	MIDLINE	PRESENT	7.5	ONLAY	7	PRESENT	PRESENT	YES	YES
7	PRABHU	39	M	38	LAPAROTOMY	MIDLINE	PRESENT	5.4	SUBLAY	3	ABSENT	ABSENT	NO	NO
8	INDRA	44	F	26	LSCS	SUPRAPUBIC	ABSENT	5.6	ONLAY	9	PRESENT	PRESENT	YES	YES
9	SUBBULAKSHMI	60	F	27	LSCS	SUPRAPUBIC	ABSENT	5.5	ONLAY	7	ABSENT	ABSENT	NO	NO
10	JOTHI	56	F	29	LSCS	MIDLINE	ABSENT	6.9	ONLAY	7	ABSENT	PRESENT	YES	YES
11	SASIKALA	35	F	26	STERLISATION	SUPRAPUBIC	ABSENT	3.1	SUBLAY	4	ABSENT	ABSENT	NO	NO
12	IDAYUNISHA	43	F	33	STERLISATION	SUPRAPUBIC	ABSENT	3.2	SUBLAY	4	ABSENT	ABSENT	NO	NO
13	MALLIGA	60	F	43	LAPAROTOMY	MIDLINE	PRESENT	5.2	ONLAY	8	PRESENT	ABSENT	NO	NO
14	JAYAPRAKASH	60	M	52	LAPAROTOMY	MIDLINE	ABSENT	4.4	SUBLAY	4	PRESENT	ABSENT	NO	NO
15	TAMILARASI	57	F	34	STERLISATION	SUPRAPUBIC	ABSENT	3.9	ONLAY	7	ABSENT	ABSENT	NO	NO
16	JAYANTHI	30	F	22	LSCS	MIDLINE	ABSENT	6.2	SUBLAY	3	ABSENT	ABSENT	NO	NO
17	MALLIGA	35	F	27	LSCS	MIDLINE	PRESENT	6.5	ONLAY	6	ABSENT	ABSENT	NO	NO
18	THENMOZHI	44	F	34	STERLISATION	SUPRAPUBIC	ABSENT	2.5	SUBLAY	5	ABSENT	ABSENT	NO	NO
19	ANBALAGAN	42	M	37	LAPAROTOMY	MIDLINE	ABSENT	6.6	ONLAY	7	ABSENT	PRESENT	YES	YES
20	THIALAGA	48	F	25	LSCS	SUPRAPUBIC	PRESENT	6.4	SUBLAY	3	ABSENT	ABSENT	NO	NO
21	RADHAMMAL	40	F	29	STERLISATION	SUPRAPUBIC	ABSENT	2.2	SUBLAY	3	ABSENT	ABSENT	NO	NO
22	ARUL	55	M	41	LAPAROTOMY	MIDLINE	PRESENT	7.4	ONLAY	8	PRESENT	PRESENT	YES	YES
23	NEELA	49	F	42	LAPAROTOMY	MIDLINE	ABSENT	5.4	ONLAY	8	PRESENT	ABSENT	NO	NO
24	RAMALAKSHMI	35	F	26	LSCS	SUPRAPUBIC	ABSENT	4.8	ONLAY	8	ABSENT	ABSENT	NO	NO
25	MANIKANDAN	42	M	40	LAPAROTOMY	MIDLINE	PRESENT	4.7	ONLAY	7	ABSENT	ABSENT	YES	NO
26	KALAISELVI	45	F	37	STERLISATION	SUPRAPUBIC	ABSENT	2.5	ONLAY	9	ABSENT	ABSENT	NO	NO
27	MARIYAM BEE	58	F	55	LAPAROTOMY	MIDLINE	ABSENT	5.3	SUBLAY	3	ABSENT	ABSENT	NO	NO
28	SURYA	30	F	23	LSCS	SUPRAPUBIC	PRESENT	6.5	ONLAY	7	ABSENT	ABSENT	NO	NO
29	RAJI	32	F	25	LSCS	SUPRAPUBIC	ABSENT	5.5	ONLAY	7	ABSENT	ABSENT	NO	NO

30	VALLI	37	F	27	LSCS	SUPRAPUBIC	ABSENT	7.5	SUBLAY	5	PRESENT	ABSENT	NO	NO
31	AMUTHA	35	F	25	LSCS	SUPRAPUBIC	PRESENT	7.2	ONLAY	8	PRESENT	ABSENT	NO	NO
32	MURUGAN	38	M	33	LAPAROTOMY	MIDLINE	ABSENT	7.1	SUBLAY	5	ABSENT	ABSENT	NO	NO
33	RAJARAJAN	42	M	36	LAPAROTOMY	MIDLINE	ABSENT	6.6	SUBLAY	5	ABSENT	ABSENT	NO	NO
34	RAGAVI	35	F	33	STERLISATION	SUPRAPUBIC	PRESENT	2.4	ONLAY	7	ABSENT	ABSENT	NO	NO
35	RAJESHWARI	61	F	41	LAPAROTOMY	MIDLINE	ABSENT	6.4	SUBLAY	5	ABSENT	ABSENT	NO	NO
36	BHUVANESHWARI	62	F	61	LAPAROTOMY	MIDLINE	ABSENT	5.9	SUBLAY	3	ABSENT	ABSENT	NO	NO
37	RAJALAKSHMI	33	F	23	LSCS	SUPRAPUBIC	PRESENT	6.3	ONLAY	8	PRESENT	PRESENT	YES	YES
38	RAJESHWARI	31	F	25	STERLISATION	SUPRAPUBIC	ABSENT	2.7	SUBLAY	4	ABSENT	ABSENT	NO	NO
39	ANBUSELVI	58	F	45	LAPAROTOMY	MIDLINE	ABSENT	6.3	ONLAY	7	PRESENT	ABSENT	NO	NO
40	KANAPPAN	62	M	56	LAPAROTOMY	MIDLINE	PRESENT	6.3	SUBLAY	4	ABSENT	ABSENT	NO	NO
41	SHVAN	53	M	48	LAPAROTOMY	MIDLINE	ABSENT	6.1	ONLAY	8	PRESENT	ABSENT	NO	NO
42	KALYANI	28	F	23	LSCS	SUPRAPUBIC	PRESENT	5.1	ONLAY	7	ABSENT	ABSENT	NO	NO
43	DEVAGI	36	F	27	LSCS	SUPRAPUBIC	PRESENT	7.1	ONLAY	7	PRESENT	ABSENT	NO	NO
44	RANIAMMAL	42	F	39	LAPAROTOMY	MIDLINE	PRESENT	6.8	SUBLAY	5	ABSENT	ABSENT	NO	NO
45	KASTURI	30	F	25	LSCS	SUPRAPUBIC	PRESENT	5.8	ONLAY	7	PRESENT	ABSENT	NO	NO
46	RANI	28	F	27	LSCS	MIDLINE	ABSENT	5.2	SUBLAY	4	ABSENT	PRESENT	NO	NO
47	KAMESWARI	44	F	38	LAPAROTOMY	MIDLINE	PRESENT	4.3	SUBLAY	4	ABSENT	ABSENT	NO	NO
48	GAYATHRI	30	F	24	LSCS	SUPRAPUBIC	ABSENT	4.2	SUBLAY	5	ABSENT	ABSENT	YES	YES
49	RAJAMMAL	36	F	28	LSCS	SUPRAPUBIC	ABSENT	6.1	SUBLAY	5	ABSENT	ABSENT	NO	NO
50	MANI	36	M	35	LAPAROTOMY	MIDLINE	ABSENT	4.5	SUBLAY	4	PRESENT	ABSENT	NO	NO